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(54) Abstract Title

Deformable airbag module

(57) An airbag module 20 includes a top wall 21, a bottom wall 22, two side walls 28, 29 and a rear wall 23, wherein each side wall is weakened by being a non planar member, such that they buckle in a controlled manner to allow the bottom wall to move towards the top wall on application of an impact force. Each side wall may have a corrugation 32 extending towards the rear wall. The bottom wall may have a stiffening rib 27 at its front edge and means such as weakened portion 35 to allow it to pivot or bend along a transverse axis towards the top wall.

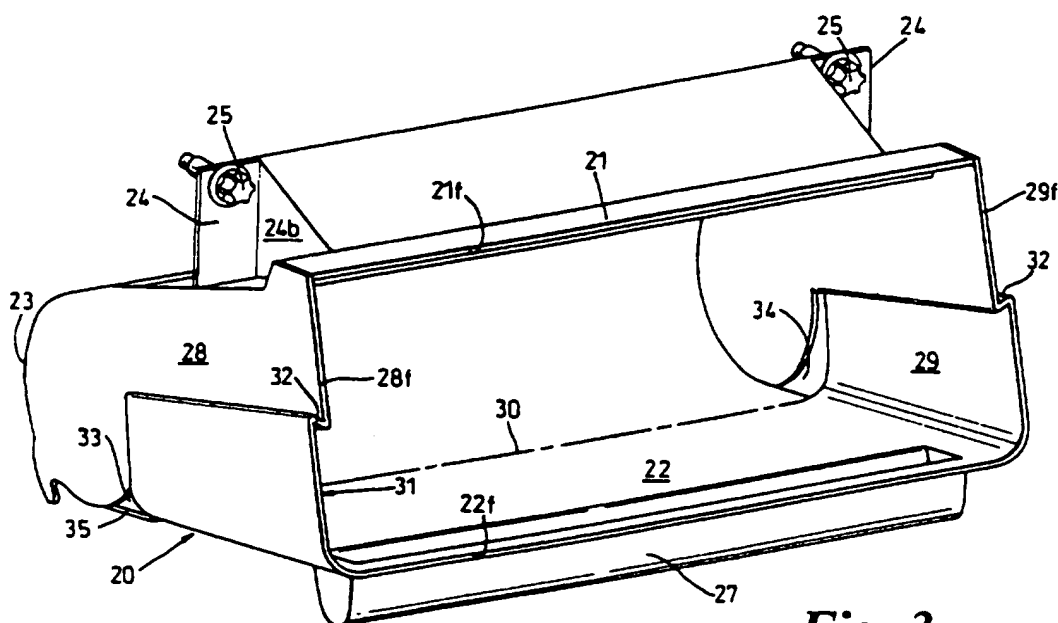
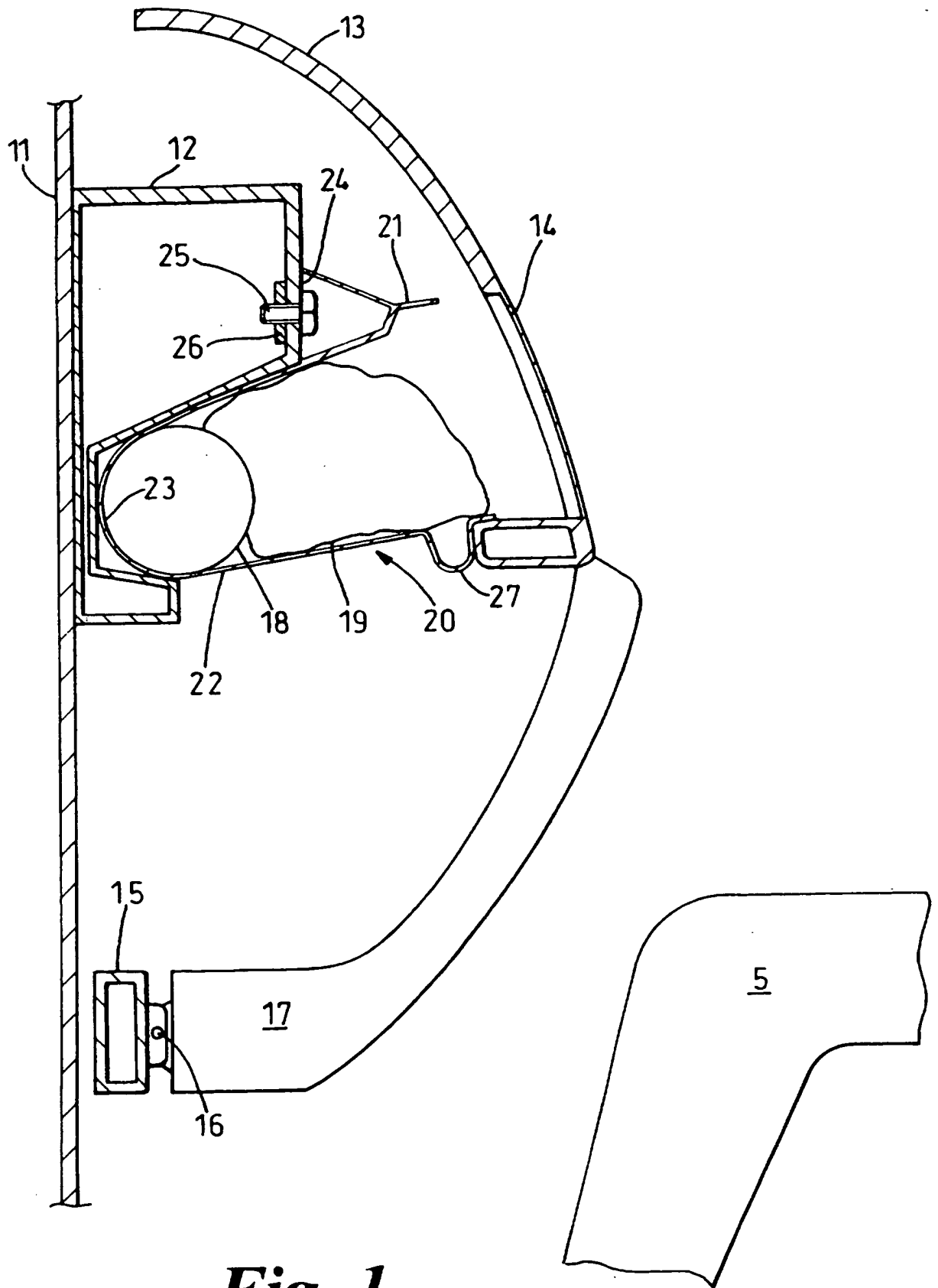
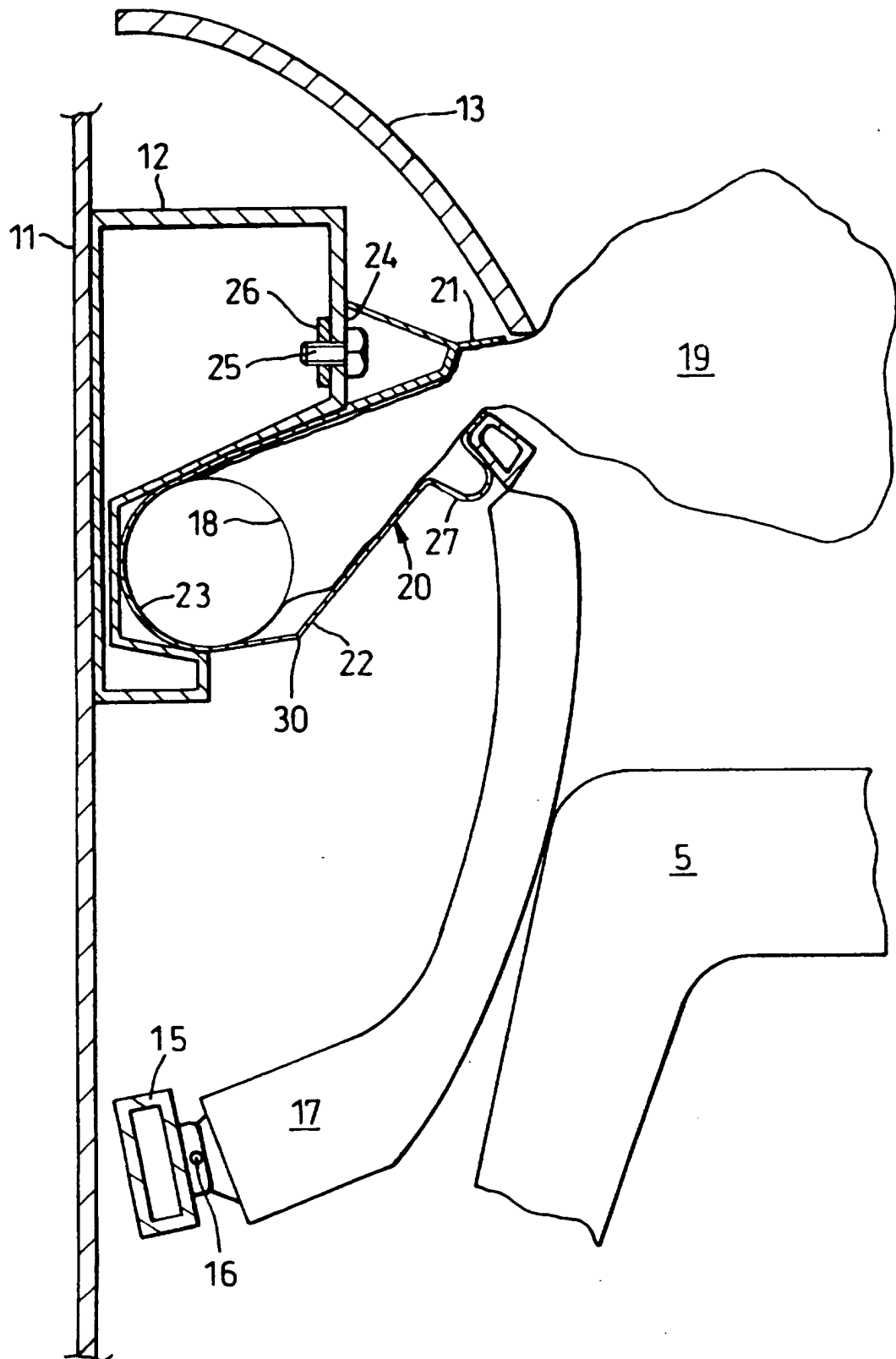


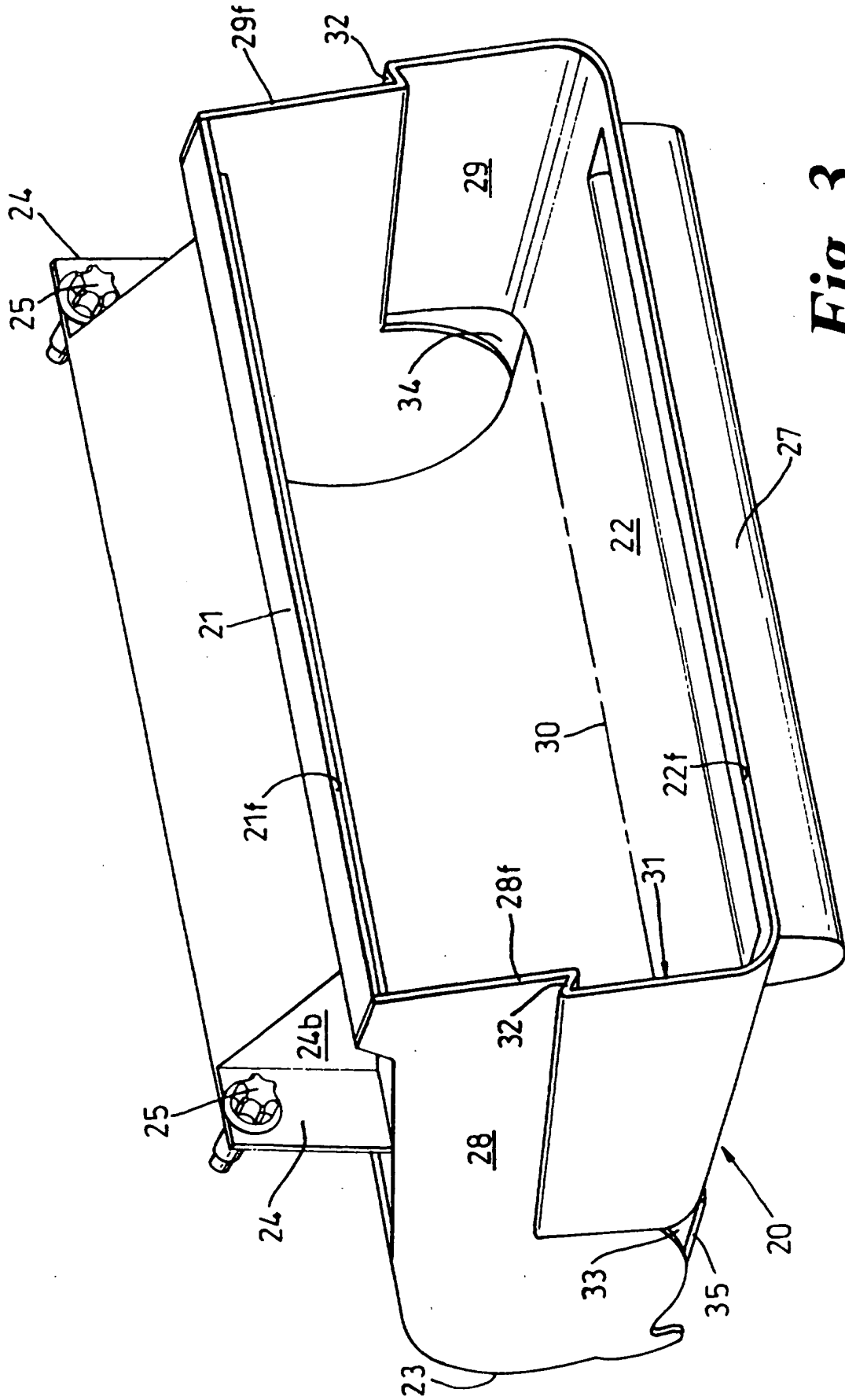
Fig. 3

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**Fig. 2**

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**Fig. 3**

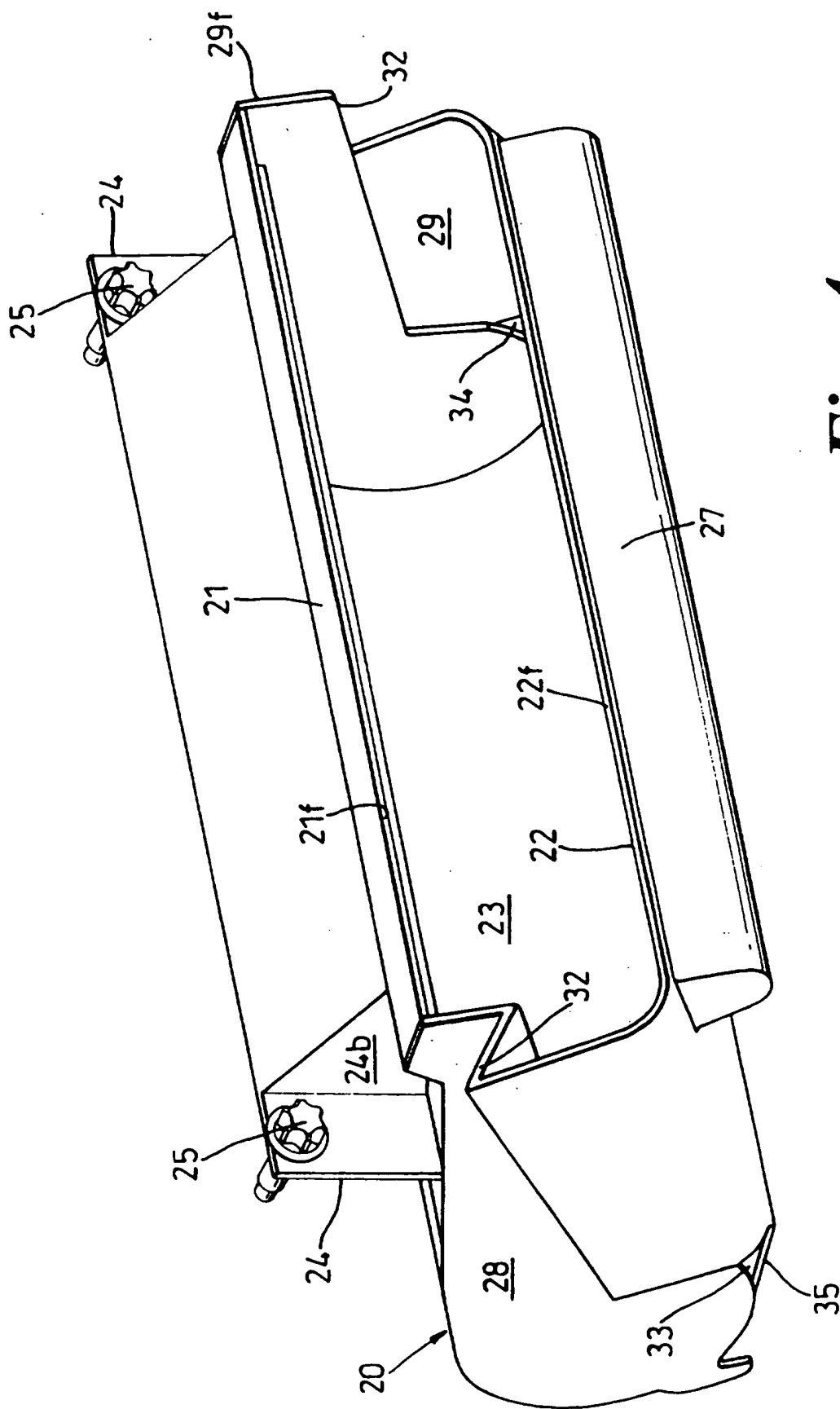


Fig. 4

A Motor Vehicle and a Motor Vehicle Airbag Module

This invention relates to motor vehicles and in particular to an airbag module for a motor vehicle.

It is well known to provide an airbag module for a motor vehicle having a container for storing an airbag and an inflation means for the airbag. It is a  
5 problem with such prior art airbag modules that the container is a rigid member that is not easily deformed.

This can be a disadvantage in a severe impact if the legs of an occupant of the vehicle contact a knee bolster assembly provided to protect the legs against injury and cause it to be pushed into contact with the container.  
10 This is because contact of the knee bolster against the rigid container will produce a sudden increase in the load acting against the legs of the passenger.

It is an object of this invention to provide an improved airbag module.

According to a first aspect of the invention there is provided a motor  
15 vehicle airbag module for housing an airbag and an inflation means, the module comprising an open ended container defined by a top plate for attaching the module to a structural part of a motor vehicle, a bottom plate, two side walls and a rear wall, the top plate, bottom plate and side walls

having front edges defining an aperture through which in use an airbag can be deployed wherein the side walls are non-planar members such that upon the application of a impact force beyond a predetermined magnitude to the bottom plate the side wall members buckle in a controlled manner thereby  
5 allowing the bottom plate to move towards the top plate.

Preferably, each side wall has at least one corrugation therein extending from or near the aperture towards the rear wall.

The top plate may have a pair of upstanding flanges attached thereto used to attach the module to a structural part of a motor vehicle in which  
10 case the top plate may be stiffened in the region of the flanges to provide a rigid fixing means for the module.

Advantageously, the bottom plate may have a stiffening rib extending parallel and near to the front edge thereof.

Advantageously, each side wall may have a cut-out therein near to its  
15 juncture with the rear wall extending from the bottom plate to a position near to the end of a corrugation so as to form a deformable portion of bottom plate near to its juncture with the rear wall.

According to a second aspect of the invention there is provided a motor vehicle having a body structure defining an engine compartment and a passenger compartment separated by a firewall, a first structural member connected to the firewall near to an upper edge on the passenger  
5 compartment side of the firewall, a second structural member extending between opposite sides of the motor vehicle on the passenger compartment side of the firewall, a knee bolster connected to said second structural member for controlled collapse in the event of an impact above a pre-determined force and an airbag module housing an airbag and an inflation  
10 means, the module comprising an open ended container defined by a top plate for attaching the module to said first structural member, a bottom plate, two side walls and a rear wall, the top plate, bottom plate and side walls having front edges defining an aperture through which the airbag can be deployed, wherein the side walls are non-planar members such that upon  
15 contact between the knee bolster and the bottom plate, the side wall members buckle in a controlled manner thereby allowing the bottom plate to move towards the top plate.

The invention will now be described by way of example with reference to the accompanying drawing in which:-

20 Fig.1 is a cross-section through a motor vehicle and airbag module according to the invention in a normal use condition;



Fig.2 is a cross-section as shown in Fig. 1 but showing the effect of an impact of a knee bolster against the airbag module;

Fig.3 is a pictorial view of an air bag module container in a normal condition; and

5        Fig.4 is a pictorial view of the airbag module container of Fig.3 showing the effect of an impact upon the container.

A motor vehicle (not shown) has a body structure defining an engine compartment and a passenger compartment separated by a firewall 11. A first structural member in the form of a light alloy box section beam 12 is  
10 connected to the firewall 11 near to an upper edge of the firewall 11 on the passenger compartment side of the firewall 11. A second structural member in the form of a cross car beam 15 extends between opposite sides of the motor vehicle where it is connected to 'A' posts (not shown) forming part of the structure of the motor vehicle.

15        The first structural member 12 is used to provide a strong support means for an airbag module 20 and a fascia member 13. The fascia member 13 has a weakened portion 14 through which an airbag 19 can force its way through during deployment.

The airbag module 20 comprises of a top plate 21, a bottom plate 22, a rear wall 23 and two side walls 28 and 29 which in combination define an open ended container. The top plate, bottom plate and side walls have front edges 21f, 22f, 28f and 29f which define an aperture or mouth through  
5 which, in use, the airbag 19 can be deployed.

An airbag inflation means 18 is mounted within the airbag module 20 and is attached to the airbag 19 so as to provide a means for inflating the airbag 19 when required.

The airbag module 20 is connected to the first structural member 12 by  
10 means of a pair of spaced apart bolts 25 each of which extends through a respective aperture in an upstanding flange 24 connected to the top plate 21. Each of the bolts is engageable with a respective nut 26 held captive on the inside of the first structural member 12. The top plate 21 is stiffened in the region of the flanges 24 by means of webs 24b which ensure that the  
15 flanges 24 are securely connected to the top plate 21. Each of the side plates 28, 29 is non-planar having a weakening corrugation 32 extending from the front edges 28f and 29f of the side walls 28 and 29 to a position near to the rear wall 23. At the end of each corrugation there is formed a cut-out 33, 34 in the respective side wall 28, 29 so as to provide a relatively easy to deform  
20 section 35 in the bottom plate 22.

Near to its front edge 22f the bottom plate 22 has a strengthening rib 27 formed therein. The strengthening rib 27 extends for substantially the entire distance between the two side walls and provides a very rigid structure in the region of the front edge 22f of the bottom plate 22.

5        During normal use the airbag module 20 is positioned, as shown in Fig.1, with the airbag 19 stored within the container in an uninflated state. When the vehicle is involved in a collision the airbag 19 is activated by accelerometer means (not shown) causing the airbag inflation means 18 to be activated thereby filling the airbag 19 with gas. If the collision is severe  
10 it is likely that part of the lower leg structure 5 of one of the occupants of the motor vehicle will contact a knee bolster in the form of a glovebox lid 17. The glovebox lid 17 is pivotally connected by means of a pivot 16 to the cross car beam 15. The object of the knee bolster 17 is to cushion the impact of an occupant's lower leg 5 should it come into contact with part of the motor  
15 vehicle. If the collision is particularly severe the knee bolster 17 will contact the lower plate 22 in the region of its front edge 22f. Because of the presence of the transverse rib 27 the bottom plate 22 is relatively rigid in this region and therefore is forced upwardly by the impact force applied from the knee bolster 17. The non-planar nature of the side walls 28 and 29  
20 and the presence of the cut-outs 33 and 34 results in the corrugations 32 being buckled or distorted by the application of this load to the bottom plate 22. This causes the bottom plate 22 to bend upwardly along a transverse

bend line 30 located within the weakened portion 35 thereby allowing it to move towards the top plate 21. The force required to buckle the corrugations 32 and bend the bottom plate 22 along the bend line 30 is relatively low and therefore the load transferred through the knee bolster  
5 17 to the lower leg structure 5 of an occupant is relatively low.

At the end of a severe collision the knee bolster 17 occupies the position shown in Fig.2 having pushed the bottom plate 22 upwardly towards the top plate 21. However the airbag 19 is not unduly affected by this upward movement of the bottom plate 22 and is still able to perform its role in  
10 protecting the upper torso and head of an occupant efficiently.

By varying the length and offset of the "Z" shaped corrugations 32 the magnitude of the force needed to buckle the side walls 28 and 29 can be adjusted so as to provide a controlled collapse of the side walls 28 and 29.

The presence of the transverse strengthening rib 27 performs a useful  
15 role in that it prevents random bending or distortion of the lower plate 22 which would make it very much more difficult to control the collapse of the side walls 28 and 29. As shown in Figs 3 and 4 the top plate 21, bottom plate 22, rear wall 23 and side walls 28 are all formed from a single piece of material that is bent to shape from a single piece of sheet metal material.  
20 However it will be appreciated that all of these parts could be made

separately and joined together or various combinations of the parts could be constructed to provide an airbag module with the correct properties.

Although the invention has been described in relation to a specific embodiment in which the side walls are out of plane by the presence of  
5 corrugations other means of producing an out of plane side wall are envisaged. For example the side wall could be bent along a front to rear axis so as to be out of plane. The object of producing an out of plane structure is that such a structure will buckle more readily when a compressive load is applied to it that a planar element that tends to act as a  
10 strut.

CLAIMS

1. A motor vehicle airbag module for housing an airbag and an inflation means, the module comprising an open ended container defined by a top plate for attaching the module to a structural part of a motor vehicle, a bottom plate, two side walls and a rear wall, the top plate, bottom plate and side walls having front edges defining an aperture through which, in use, an airbag can be deployed wherein the side walls are weakened by being non-planar members such that upon the application of a impact force beyond a predetermined magnitude to the bottom plate the side wall members buckle in a controlled manner thereby allowing the bottom plate to move towards the top plate.
2. A module as claimed in Claim 1 in which each side wall has at least one corrugation therein extending from or near the aperture towards the rear wall.
3. A module as claimed in Claim 1 or in Claim 2 in which the top plate has a pair of upstanding flanges attached thereto used to attach the module to a structural part of a motor vehicle.
4. A module as claimed in Claim 5 in which the top plate is stiffened in the region of the flanges to provide a rigid fixing means for the module.

5. A module as claimed in any preceding Claim in which the bottom plate has a stiffening rib extending parallel and near to the front edge thereof.
6. A module as claimed in any preceding Claim in which each side wall has a cut out therein near to its juncture with the rear wall extending from the bottom plate to a position near to the end of a corrugation so as to form a deformable portion of bottom plate near to its juncture with the rear wall.
7. A motor vehicle airbag module for housing an airbag and an inflation means substantially as described herein with reference to the accompanying drawing.
8. A motor vehicle having a body structure defining an engine compartment and a passenger compartment separated by a firewall, a first structural member connected to the firewall near to an upper edge on the passenger compartment side of the firewall, a second structural member extending between opposite sides of the motor vehicle on the passenger compartment side of the firewall, a knee bolster connected to said second structural member for controlled collapse in the event of an impact above a pre-determined force and an airbag module housing an airbag and an inflation means, the module comprising an open ended

container defined by a top plate for attaching the module to said first structural member, a bottom plate, two side walls and a rear wall, the top plate, bottom plate and side walls having front edges defining an aperture through which the airbag can be deployed, wherein the side walls are non-planar members such that upon contact between the knee bolster and the bottom plate, the side wall members buckle in a controlled manner thereby allowing the bottom plate to move towards the top plate.

9. A motor vehicle substantially as described herein with reference to the accompanying drawing.





Application No: GB 9726108.5  
Claims searched: 1 to 8

Examiner: Karl Whitfield  
Date of search: 17 April 1998

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): B7B (BSBCR, BSDB)

Int Cl (Ed.6): B60R 21/04, 21/045, 21/16, 21/20, 21/22

Other: Online database: Derwent World Patents Index accessed via Questel

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
X, E	EP 0823353 A1 (AUTOLIV) especially col 1 ll 27-45	1 at least
A	US 5533747 (ROSE) especially figures 2 & 3	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
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